

REMARKS

Favorable reconsideration of this application, as presently amended and in light of the following discussion, is respectfully requested.

Claims 1-22 are currently pending, with Claims 17-22 withdrawn as directed to a non-elected invention. Claims 1-16 have been amended; and Claim 4 has been cancelled without prejudice by the present amendment. The changes to the claims are supported by the originally filed specification and do not add new matter.

In the outstanding Office Action, Claims 1, 2, 4, 5, and 11 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,510,630 to Agarwal et al. (hereinafter “the ‘630 patent”) in view of U.S. Patent No. 6,242,784 to Zeng et al. (hereinafter “the ‘784 patent”); Claim 3 was rejected under 35 U.S.C. § 103(a) as being unpatentable over the ‘630 and ‘784 patents, further in view of U.S. Patent No. 6,184,556 to Yamazaki et al. (hereinafter “the ‘556 patent”); and Claims 6-10 and 12-16 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the ‘630 and ‘784 patents, further in view of Hu et al. (“Hot-Electron-Induced MOSFET Degradation—Model, Monitor, and Improvement”) (hereinafter “the Hu reference”).

Amended Claim 1 is directed to a method of manufacturing a semiconductor device, comprising: (1) forming a semiconductor element in a semiconductor active region, *the semiconductor active region being in an electrically floating state*, and calculating a generation rate of electron hole pairs caused by impact ionization in the semiconductor element; (2) calculating a volume integral of the generation rate of electron hole pairs in an area where the impact ionization is caused; (3) evaluating time-dependent variations of electrical characteristics of the semiconductor element on the basis of the volume integral; and (4) manufacturing a semiconductor device based on results of the evaluating step. Claim 1 has been amended to clarify that the semiconductor element is formed in a semiconductor

active region, *the semiconductor active region being in an electrically floating state*. The changes to the claims are supported by the originally filed specification and do not add new matter.²

Regarding the rejection of Claim 1 under 35 U.S.C. § 103, the Office Action asserts that the '630 patent discloses everything in Claim 1 with the exception of calculating the generation rate of electron hole pairs caused by impact ionization, and relies on the '784 patent to remedy that deficiency.

The '630 patent is directed to a non-volatile random access memory cell constructed of silicon carbide. As shown in Figure 2A, the '630 patent discloses p and p+ layers 18 and 20, that function as either well regions or isolation regions. Moreover, the '630 patent discloses that the lower the generation rate of electron hole pairs, the smaller the leakage current value. However, as admitted in the Office Action, the '630 patent fails to disclose calculating the generation rate of electron hole pairs caused by impact ionization, as recited in amended Claim 1. Moreover, Applicants submit that the '630 patent fails to disclose calculating the *volume integral* of the generation rate of electron hole pairs in an area where the impact ionization is caused. Accordingly, it follows that the '630 patent also fails to disclose the steps of (1) evaluating time-dependent variations of electrical characteristics on the basis of the volume integral, and (2) manufacturing a semiconductor device based on the results of the evaluating step. Moreover, Applicants submit that the '630 patent fails to disclose the semiconductor region being *in an electrically floating state*, as recited in amended Claim 1.

Turning now to the secondary reference, the '784 patent is directed to a process for forming a silicon die having improved edge termination. The '784 patent discloses that the withstand pressure of a semiconductor element is evaluated based on the position where

² See, e.g., original Claim 4.

impact ionization is extensively performed and the maximum rate of impact ionization. However, Applicants submit that the '784 patent fails to disclose calculating a *volume integral* of the generation rate of electron hole pairs in an area where the impact ionization is caused, as recited in amended Claim 1. Accordingly, it follows that the '784 patent also fails to disclose the steps of (1) evaluating time-dependent variations of electrical characteristics based on the volume integral, and (2) manufacturing a semiconductor device based on the results of the evaluating step. Moreover, Applicants respectfully submit that the '784 patent fails to disclose that the semiconductor active region is *in an electrically floating state*, as recited in amended Claim 1.

Thus, no matter how the teachings of the '630 and '784 patents are combined, the combination does not teach or suggest (1) forming a semiconductor element in a semiconductor active region, *the semiconductor active region being in an electrically floating state*; (2) calculating the *volume integral* of the generation rate of electron hole pairs in an area where the impact ionization is caused; and (3) evaluating time-dependent variations of electrical characteristics of the semiconductor element on the basis of the *volume integral*, as recited in amended Claim 1. Accordingly, Applicants respectfully traverse the rejection of Claim 1 (and dependent Claims 2 and 5) as being unpatentable over the '630 and '784 patents. Moreover, Applicants respectfully submit that the rejection of Claim 4 is rendered moot by the present cancellation of that claim.

Claim 11 recites limitations analogous to the limitations recited in amended Claim 1. Moreover, Claim 11 has been amended in a manner analogous to the amendment to Claim 1. Accordingly, for the reasons stated above for the patentability of Claim 1, Applicants respectfully traverse the rejection of Claim 11 as unpatentable over the '630 and '784 patents.

Regarding the rejection of Claim 3 under 35 U.S.C. § 103, Applicants respectfully submit that the '556 patent fails to remedy the above-noted deficiencies of the '630 and '784

patents. Accordingly, Applicants respectfully traverse the rejection of dependent Claim 3 as being unpatentable over the '630, '784, and '556 patents.

Claim 12 is directed to a method of manufacturing a semiconductor device, comprising, *inter alia*: (1) forming a first insulated gate field effect transistor having a body contact electrode and a first semiconductive active region; (2) forming a second insulated gate field effect transistor without a body contact electrode in a second semiconductor active region, *the second semiconductor active region being in an electrically floating state*, on said insulated film layer, and calculating the generation rate of electron hole pairs caused by impact ionization in the second insulated gate field effect transistor; (3) calculating a *volume integral* of the generation rate of the electron hole pairs and a region where impact ionization is caused; (4) calculating time-dependent variations of electrical characteristics of the second insulated gate field effect transistor on the basis of the volume integral; and (5) manufacturing a semiconductor device on the basis of the calculated time-dependent variations of electrical characteristics. Claim 12 has been amended to clarify that *the second semiconductor active region is in an electrically floating state*. The changes to Claim 12 are supported by the originally filed specification and do not add new matter.

Regarding the rejection of Claim 12 under 35 U.S.C. § 103(a) as unpatentable over the '630 patent, the '784 patent, and the Hu reference, Applicants respectfully submit that the Hu reference fails to remedy the above-noted deficiencies of the '630 and '784 patents. In particular, the Hu reference, which describes time-dependent variations of electrical characteristics of a semiconductor element whose substrate current can be measured, fails to disclose (1) calculating a *volume integral* of the generation rate of electron hole pairs in a region where impact ionization is caused, and (2) calculating time-dependent variations of electrical characteristics of a second insulated gate field effect transistor on the basis of the volume integral. Moreover, Applicants submit that the Hu reference fails to disclose forming

a second insulated gate field effect transistor with a body contact electrode in a second semiconductor active region, *wherein the second semiconductor active region is in an electrically floating state*, as recited in amended Claim 12. Accordingly, Applicants respectfully traverse the rejection of Claim 12 as unpatentable over the '630 patent, '784 patent, and the Hu reference.

Claims 13 and 14 recite limitations analogous to the limitations recited in amended Claim 12. Moreover, Claims 13 and 14 have been amended in a manner analogous to the amendment to Claim 12. Accordingly, for the reasons stated above for the patentability of Claim 12, Applicants respectfully traverse the rejection of Claim 13 and Claim 14 (and dependent Claims 15 and 16) as unpatentable over the '630 patent, '784 patent, and the Hu reference.

Regarding the rejections of dependent Claims 6-10 under 35 U.S.C. § 103, Applicants respectfully submit that the Hu reference fails to remedy the above-noted deficiencies of the '630 and '784 patents. Accordingly, Applicants respectfully traverse the rejection of dependent Claims 6-10 as unpatentable over the '630 patent, the '784 patent, and the Hu reference.

Thus, it is respectfully submitted that independent Claims 1, 11, 12, 13, and 14 (and all associated dependent claims) patentably define over any proper combination of the '630 patent, the '784 patent, the '556 patent, and the Hu reference.

Consequently, in view of the present amendment and in light of the above discussion, the outstanding grounds for rejection are believed to have been overcome. The application, as amended herewith, is believed to be in condition for formal allowance. An early and favorable action to that effect is respectfully requested.

Respectfully submitted,

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